riot: **R** **I**nput-**O**utput **T**ools

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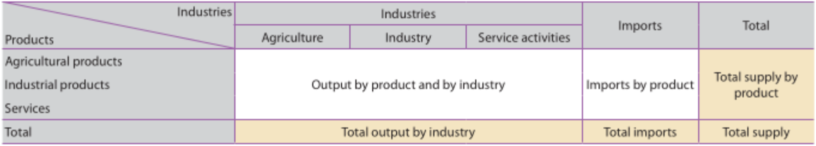
Introduction

- `riot` contains functions to deal with
  - **supply and use tables (SUTs)** and
  - **input-output tables (IO)**
- Functions are implemented in **Rcpp (Armadillo)**, see Eddelbuettel and Francois (2011)
- Package is used in creation of **WIOD** (World Input-Output Database: www.wiod.org), Timmer et al. (2015)

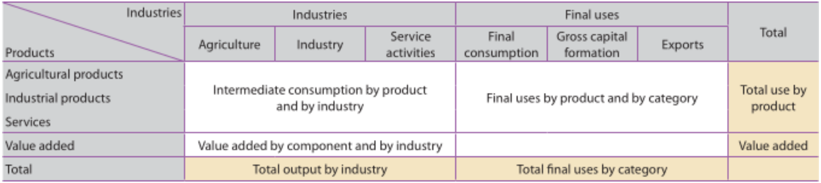
Supply and use tables

- Supply table: output + imports



Industries Products	Industries			Imports	Total
	Agriculture	Industry	Service activities		
Agricultural products Industrial products Services	Output by product and by industry			Imports by product	Total supply by product
Total	Total output by industry			Total imports	Total supply

- Use table: intermediate consumption + final consumption



Industries Products	Industries			Final uses			Total
	Agriculture	Industry	Service activities	Final consumption	Gross capital formation	Exports	
Agricultural products Industrial products Services	Intermediate consumption by product and by industry			Final uses by product and by category			Total use by product
Value added	Value added by component and by industry						Value added
Total	Total output by industry			Total final uses by category			

Functions

Let's go over the functions and how they are used in practice.

```
library(riot)
```

Create a SUT object

- Uses R6 object system

```r
sut_aut <- SUT$new(supply_table,
                   import_vector,
                   use_table,
                   "AUT", 2010)
## test if product rows and industry columns add up
sut_aut$testConsistency()
```

Aggregate to different industry classification

- When new industry data is not yet as detailed available

```
## from 64 industries to 38 industries
sut_aut$aggregateCols(nace_r2_a38_classification)
```

Update to new industry data, #1

- SUTs were published every five years, nowadays yearly (EU)
- Uses SUTRAS algorithm, see Temurshoev and Timmer (2011)
- benchmarks SUTs to new industry data
- ensures tables are consistent (product sums match)

Update to new industry data, #2

- Input: industry level gross output and intermediate consumption data (two vectors)

```
sut_aut$updateSUT(aut_2018_nace_r2_a38_data,
                  maxiter = 10000,
                  epsilon = 1e-10)
```

Calculate the Input-Output table

- Several transformation types in Eurostat Manual: Beutel (2008)
- Product by product or industry by industry

```r
## Product by product table
io_aut_2018 <- calcIO(sut_aut_2018, model = "B")
## Industry by industry table
io_aut_2018 <- calcIO(sut_aut_2018, model = "D")
```

Additional functions

#1: GRAS algorithm

- Balancing/updating a matrix to new row and column sums
- Often used for preparing supply and use tables, trade matrizes
- Junius and Oosterhaven (2003) and Temurshoev, Miller, and Bouwmeester (2013)

```
doGRAS(A_matrix, new_row_sums, new_col_sums,
       epsilon, maxiter, verbose)
```

#2: Random walk centrality

- View input-output table as a weighted graph
- Calculate the most “central” nodes
- Uses Sherman-Morrison-Woodbury formula for updating inverse matrices
- Algorithm defined by Blöchl et al. (2011)

```
rwCentrality(io_matrix)
```

Conclusion

- Layer of abstraction for working with supply and use tables
  - when working with 50+ countries and ~15 years
- Significant performance increase compared to previous implementation in Stata and base R
- Use unit tests for ensuring correctness

Links and further information

- Development version: https://gitlab.com/zauster/riot
- wiiw: http://www.wiiw.ac.at
- World Input-Output Database: http://www.wiod.org
- Blog (explaining some implementations): https://zauster.gitlab.io/blog/

References

Thank you for your attention!

Beutel, Jörg. 2008. *Eurostat Manual of Supply, Use and Input-Output Tables*. 2008 Edition. Luxembourg: Amt für amtliche Veröffentlichungen der Europäischen Gemeinschaften.

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Temurshoev, Umed, and Marcel P. Timmer. 2011. "Joint Estimation of Supply and Use Tables." *Papers in Regional Science* 90 (4): 863–82. https://doi.org/10.1111/j.1435-5957.2010.00345.x.

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